

and the fronds, in this case, were rather small and poor to start with.)

After this the specimens showed a gradual decline both in the quickness of their response when supplied with moisture, and in the relative number of fronds that completely regained their normal condition. On March 8, 1915, after 7 months and 6 days in my study and 7 months in the basement—a total of more than 14 months without water, the last remaining fragment of the mat was placed out of doors on a rainy day, but only 2 fronds expanded fully and regained their normal color. The specimen was then left on a rock under the drip of a gutter on the north side of my house, but it never revived further, and finally died.

THE VEGETATION OF A CINDER FIELD

BY GEORGE T. HASTINGS

In the summer of 1916 the Palisade Interstate Park Commission completed the reclaiming of some three acres on the west shore of the Hudson River opposite Hastings. A wall of boulders taken from a rock slide immediately to the north was built across the front of a shallow bay and the space between this and the shore filled in. The filling was first of ashes and rubbish from one to six feet in depth, over this a layer of cinders six inches to a foot in thickness was placed and the whole leveled off. The ashes and cinders were brought up from New York in scows and distributed by small cars run on a track that was shifted as the filling progressed. The final level is about three feet above high tide level. This cinder field made as nearly a sterile soil and one that could retain as little moisture as could well be imagined. The water level in the soil was near the surface and most of the available water for young plants was due to capillarity. The filling was completed so late in 1916 that there was little opportunity for any plant life to develop, but during the summer of 1917 the area became well covered with plants, chiefly growing individually with bare cinders all around but in places crowded together. The following year the tract was covered

with a layer of clayey soil about three inches thick and but few of the plants of the year before reappeared. In 1917 ninety-six species of flowering plants were found. No fern of any kind and but one little patch of moss, the latter on the ashes of a pick-nicker's fire and not reaching maturity, was found. The flora was distinctively a weed one with little relation to the native flora on the adjacent hillside. Possibly the only plants to come from the immediate vicinity were a few seedlings of the small-toothed aspen, poison ivy, red-berried elder, and poke-berry, one vigorous shoot of *Paulownia* in the rock wall—probably brought from the rock slide at the north where two good-sized trees of the kind grow—and a few heart-leaved asters. Aside from these six species all the plants, including all the abundant ones, seemed to have been brought from a distance. Some twenty-four species have seeds definitely adapted to wind dispersal and three or four are sticktights, these may have been brought in by wind and animals, nearly all the remainder have small seeds with no special adaptation for dispersal over long distances and were apparently brought either with the cinders, on the ties of the railroad, or by the laborers. To the latter undoubtedly were due the fruits, apple, cherry, strawberry and raspberry. An interesting case was that of the Mexican tea, *Chenopodium ambrosioides*, that in several places grew in well-defined lines of two hundred feet or more along the course of the small railroad. Probably the seeds had adhered to the ties and been jarred off where the track had remained in one place for some time. In midsummer petunias and morning glories of several color varieties and sweet alyssum were abundant over the whole area, and in the fall numerous plants of *Kochia* added bits of brilliant color. Many of the individual plants, having no close neighbors to crowd them, attained very large size. Single plants of *Panicum capillare* and *P. proliferum* grew to three and four feet in height and covered from ten to sixteen square feet. Late in the summer some of the species were crowded by seedlings. Under one plant of *Euphorbia maculata* that made a mat three feet in diameter the cinders were thickly covered with tiny seedlings. On one square foot over two thousand were counted.

As would be expected of a weed flora few of the plants were native, only 29 per cent., and over half were annuals. None of the trees on the hillside near by were represented by seedlings though their seeds must have been scattered over the field in the fall. Black birches hung over the edge of the filled land but the only birch seedlings were of the grey birch, possibly from a few small trees some distance to the south along the base of the slope. Seeds of many of the shrubs and herbs of the slope of the Palisades must have been blown onto the area during the fall and early spring, but conditions on the cinders were not favorable to germination.

The orders best represented were the grasses, with 17 species and the composites, with 22—the two together representing more than 40 per cent. of the species—the grasses exceeding all other plants in the abundance of individuals. Indications were that many of the plants would survive for many seasons and give character to the flora until sufficient humus had accumulated to give foothold to other species. But the covering of the cinders the following year either buried the seeds too deeply or brought in so many sod-forming grasses as to crowd them out. A few still persist but are not the dominant forms. A patch of sunflowers has come since where the one plant grew in 1917 but the petunias, morning glory, *Kochia* and most of the others have not reappeared. The plants found were as follows:

<i>Syntherisma fimbriata</i>	abundant over a small area.
<i>Panicum capillare</i>	abundant over most of the area.
<i>Panicum proliferum</i>	a few large clumps.
<i>Echinochloa crus-galli</i>	common.
<i>Chaetochloa viridis</i>	widespread.
<i>Chaetochloa verticillata</i>	one or two plants.
<i>Chaetochloa Italica</i>	a very few plants.
<i>Muhlenbergia sylvatica</i>	a very few plants.
<i>Phleum pratense</i>	a very few plants.
<i>Aira caryophyllea</i>	a very few plants.
<i>Avena sativa</i>	a few, possibly from horse feed—as horses were used in leveling the tract after filling.
<i>Eleusine Indica</i>	few.
<i>Eragrostis major</i>	very few.
<i>Eragrostis capillaris</i>	few.

- Poa annua* few.
Puccinellia distans very few.
Lolium perenne very few on masses of good soil close
to the inner edge of the fill.
Cyperus strigosus very few.
Commelina communis very few.
Populus tremuloides very few seedlings.
Betula populifolia few seedlings.
Rumex crispus two or three plants.
Rumex acetosella few.
Polygonum punctatum, leptostachyum very few.
Polygonum convolvulus few.
Polygonum pennsylvanicum few.
Polygonum aviculare two or three plants.
Kochia Scoparia common over whole area.
Chenopodium ambrosioides abundant.
Chenopodium album common.
Atriplex hastata very few.
Amaranthus retroflexus few.
Phytolacca decandra six or seven plants, all small.
Mollugo verticillata abundant.
Portulaca oleracea very few.
Konigia maritima abundant.
Lepidium apetalum abundant.
Brassica nigra very few.
Brassica oleracea very few.
Malus Malus few seedlings.
Fragaria sp. several seedlings.
Potentilla monspeliensis very few.
Rubus occidentalis one young plant.
Amygdalus Persica few seedlings.
Trifolium pratense very few.
Trifolium repens few.
Trifolium hybridum few.
Melilotus alba very few.
Medicago sativa one plant.
Medicago lupulina very few.
Oxalis stricta two plants.
Acalpha virginica abundant.
Euphorbia maculata abundant, and a great number of seed-
lings in the fall, 2,016 found on one
square foot under a large plant.
Rhus radicans two or three seedlings.
Epilobium hirsutum very few.
Epilobium adenocaulon very few.
Chamaenerion angustifolium very few.
Onagra biennis few.
Ipomoea purpurea abundant over whole tract.

- Verbena urticifolia*very few.
Verbena hastatavery few.
Petunia violaceaabundant.
Lycopersicon Lycopersiconseveral.
Solanum nigrumfew.
Physalis pruinosavery few.
Lycium vulgareone plant.
Verbascum Thapsusfew.
Linaria Linariavery few.
Paulownia tomentosaone vigorous shoot at the edge of the
water from a piece of branch wedged
between rocks in the retaining wall.
Plantago Rugellivery few.
Plantago lanceolatavery few.
Plantago majorvery few.
Sambucus pubenstwo plants.
Cucumis meloone vigorous plant producing several
melons.
Eupatorium purpureumtwo or three plants, all small.
Eupatorium perfoliatumone small plant.
Euthamia graminifoliavery few.
Aster cordifoliusvery few.
Erigeron annuusvery few.
Leptilon canadensisabundant, many with abnormalities of
the flower clusters.
Anaphalis margaritaceavery few.
Gnaphalum obtusifoliumvery few.
Helianthus annuusone plant.
Bidens frondosafew.
Bidens bipinnatafew.
Galinsoga parviflorafew.
Achillea Millefoliumfew.
Chrysanthemum Leucanthemumvery few.
Erechtites hieracifoliafew.
Arctium minusvery few.
Carduus lanceolatusone small plant.
Taraxacum Taraxacumfew.
Lactuca virosavery few.
Sonchus aspervery few.
Ambrosia artemisiaefoliavery few.
Xanthium echinatumvery few.